A Cyber Proving Ground

The Search for Cyber Genius

Lt Col Kristal L. M. Alfonso, USAF*

The search for cyber leadership has followed standard military protocols: officers with proven worth in their respective fields have risen to senior ranks and assumed leadership positions in the "cyber mission." Success in the traditional war paradigm, however, does not necessarily equate to success in the cyber realm. Nor does military genius based on Clausewitzian parameters necessarily manifest itself as cyber genius.

I propose a new approach to unlocking potential cyber genius, not on a Clausewitzian battlefield but within the cyber realm itself. This approach derives loosely from the Army's Aberdeen Proving Grounds and involves development of a comparable Cyber Proving Ground (CPG) system. CPGs could allow the US military and other government agencies to discover untapped talent capable of leading and defending America's interests in the cyber realm. I do not suggest that Clausewitzian genius is no longer applicable in an age of cyber warfare, only that it is not necessarily transferable from physical battlefields to cyberspace. Cyber genius does not depend upon the trinity of war, and the US military should not use Clausewitzian standards to search for the Napoléon of cyberspace.

Carl von Clausewitz defined genius as "a very highly developed mental aptitude for a particular occupation" and used it to differentiate between competent and great military commanders.[1] Although genius is an easy trait to describe, Clausewitz asserted that it was exceedingly rare and emerged only during the violence of warfare. He thought that great military genius could not arise without the "paradoxical trinity" of war; specifically, violence, chance, and subordination to policy govern war and its military leaders.[2]

The advent of the cyber domain, however, defies Clausewitzian notions of military genius and challenges traditional approaches to command. For example, the physical violence inherent to war does not exist within the cyber realm. Nor do the demands of traditional war: strength, physical courage, and the ability to cope with violent death. The concepts of cyber and virtual conflicts, unfortunately, seem too abstract for many military leaders to comprehend. Instead, their responses remain consistent with previous approaches to revolutions in military affairs (RMA): deny the revolution, operate as before, and apply tried and true doctrine of past successful models to the RMA (e.g., one need only look at the evolution of the Air Force). In cyberspace the US military has focused on domination and denial, based on the success of current air, land, and sea doctrines, instead of considering more adaptive approaches that could warrant greater successes but at much greater risks.

Where Is the Next Bobby Fischer?

Clausewitz identified only two true military geniuses: Napoléon Bonaparte and Frederick the Great. Both men demonstrated the necessary coup d'oeil, or strategic insight, and the determination that, according to Clausewitz, defined military

*The author is deputy chief, Engagement Division, Air Force Research Institute, Maxwell AFB, Alabama.

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2010		**00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
A Cyber Proving Ground: The Search for Cyber Genius	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air Force Research Institute (AFRI),155 N Twining Street,Maxwell AFB,AL,36112**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**6**	

genius; however, without actual wars to reveal their genius, neither may have secured his place in history.[3] War is a relatively rare occurrence since most states regard it as a last resort of political discourse between nations. Therefore, potential military genius may go undiscovered since very few large, modern wars have occurred to test a multitude of military commanders.

In contrast, cyberspace offers numerous opportunities to discover genius. Instead of seeking rare opportunities to demonstrate this trait, prospects can develop and engage in virtual warfare to challenge their abilities as potential cyber leaders. Unfortunately, current military leaders and the military cyber system in which they operate ignore novel ways of discovering leadership abilities and genius. Rather, they adhere to traditional methods of leadership development, promotion, and command selection as the only appropriate means for determining combat leaders.[4] Although some services have attempted to adopt more innovative approaches to recruiting and training (e.g., America's Army and the Air Force MyBase), a Western approach to imparting knowledge remains inherent in these approaches. According to Dr. Parker Palmer, the dominant model of truth telling and truth knowing involves four major elements (see figure).

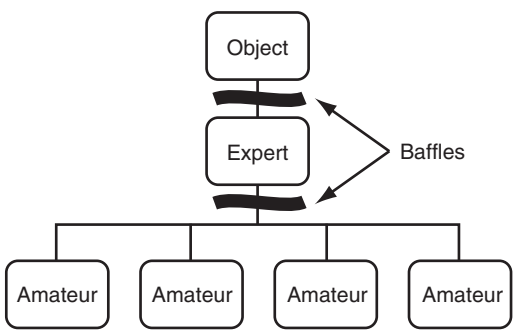

Figure. Elements of truth telling and truth knowing. (Adapted from Parker J. Palmer, *The Courage to Teach: Exploring the Inner Landscape of a Teacher's Life* [San Francisco: Jossey-Bass, 1998], 103.)

Palmer notes that the *object* is the "knowledge that reside[s] . . . somewhere . . . in physical or conceptual space, as described by the 'facts' "; the *experts* are "people trained to know these objects in their pristine form without allowing their own subjectivity" to affect the description of the object. The *amateurs* are "people without training . . . who depend on the experts" to gain knowledge, and the *baffles* occur between the transmissions, serving as the lens through which knowledge flows from the expert to the amateur but usually not in reverse.[5] This model follows the hierarchical model ingrained in the modern US military system and its education system—one that creates tremendous difficulties for any attempt to educate and develop personnel by using new methods that depart from the traditional teacher-student or expert-amateur model. With regard to cyberspace knowledge and experience, though, the paradigm has reversed itself: individuals traditionally considered amateurs or students, based on age and experience, have become the experts. Considered digital or net natives, members of the younger generation, who have grown up surrounded by and using the Internet and associated platforms, are actually teaching members of the older generation, who are digital or net immigrants.

Thus, regarding cyber education, Department of Defense (DOD) leaders must directly challenge the bureaucratic traditions currently embodied by the military services in order to adopt innovative education and training techniques that recognize this shift in the knowledge structure. Similar to civilian organizations that face challenges to their traditional hierarchy, the DOD must "break down deep-rooted biases that inhibit [it] from seizing opportunities to open up innovation."[6] Biases within the DOD's military command and control structure are obvious, beyond the traditional education model employed by the services; that is, officers must meet certain education, age, personal comportment, and physical requirements in order to be considered for command positions. Within each of the ser-

vices, demands for combat experience also limit the pool of potential commanders: fighter pilots dominate Air Force leadership, infantry officers dominate Army leadership, and blue-water ship commanders dominate Navy leadership. Given such self-imposed restrictions on potential leaders, the rarity of Clausewitzian genius comes as no surprise. These stringent standards should not apply to the cyber domain simply because they hinder the DOD's ability to discover and develop cyber genius.[7]

The demand for experts in the highly competitive, continuously evolving world of computer programming, engineering, and cyber applications remains extremely high.[8] The task of finding cyber genius and expertise continues to confront civilian organizations as well as government institutions. In light of this high demand and the challenges of finding and hiring people with the required expertise, any organization seeking to remain competitive must adapt innovative methods for acquiring and retaining this talent. The military, which needs this expertise to remain effective in its national security mission, must seek alternatives to traditional recruiting and education methods that will facilitate the discovery and maturing of cyber genius. If properly developed and nurtured, CPGs not only could mitigate the rarity of genius and provide one method to develop it but also could produce a number of additional benefits. Like the agoras or marketplaces of ancient Athens, modern "ideagoras" "make ideas, inventions, and scientific expertise around the planet accessible."[9]

Based on the concept of an ideagora, CPGs could make diversity of thoughts and ideas an asset to the DOD and other agencies. The ideagora potential inherent in the CPG could provide the next evolution of Goldwater-Nichols.[10] Instead of having to train and practice in the real world at great expense, participants from a multitude of government agencies could interact and train within the CPG, which could easily be a joint military system. The Army's use of a "first person shooter" gaming system to recruit new personnel and the current remotely piloted aircraft systems employed by the Air Force, Army, and Navy establish the military's level of comfort with using cyberspace to enhance performance and mission effectiveness. The CPG could take the military applications of cyberspace to a higher level by incorporating other components within the US government.

Just as participants in the virtual world known as *Second Life* interact with other players via financial and educational applications, so could personnel from multiple agencies interact within military, financial, policing, educational, and infrastructure applications. For example, as members of the military engage in operations such as counterinsurgency, State Department participants can simultaneously involve themselves in establishing government infrastructure. As the CPG adapts to inputs from participants, it can create new challenges for military and State participants. In this example, if military actions taken by DOD personnel result in collateral damage at a nearby school, both the military and State individuals will have to seek a means to overcome backlash from the local population.

This example illustrates a CPG's most obvious benefit: freedom to evaluate a variety of participants continually. In the search for the next cyber genius, a CPG could allow the DOD to test both nonmilitary and military participants—at minimal cost and with much-needed interagency engagement.[11] A CPG could quickly cull marginal or inept participants and promote the more capable ones. With each increasing level of difficulty, the system could narrow the advancing fields while simultaneously evaluating new candidates at introductory levels. A system similar to the "Elo" rating system used in the analog strategies of games like chess and *Go* could track competitors, ranking and bracketing them against each other within the CPG. Participants would receive points based on their performance, which in turn would elevate, sustain, or demote them to the appropriate level of challenge.

Within the world of chess, the Elo ranking system has largely mitigated the as-

sumptions of genius built upon physical successes. In order to reach the level of Clausewitzian genius in the more traditional domains of warfare, one would have to demonstrate physical capability in addition to the mental agility required of coup d'oeil. Someone with perceived physical weaknesses, such as paralysis or even traits associated with gender, could be dismissed outright without any examination of his or her mental ability simply because of the physical demands of traditional warfare. Chess, however, like other games of strategy, relies upon the mental agility and ability of the player to predict an opponent's future moves and has no correlation to physical capability. The demands of cyber operations more closely relate to the rigors of competitive chess than to the rigors of physical combat. In a CPG, the system could measure participants on their performance, similar to the evaluation of chess players.

Failure to learn and adapt could result in an initial denial of "genius" level, but that would not necessarily end the scenario or challenge. The participant could continue to interact with and improve the system as both producer and consumer, or *prosumer*, a term coined by strategist Don Tapscott.[12] Even though a participant may initially fall short of genius-level rating, feedback from the CPG could remediate deficiencies of the individual or group and encourage improved decision-making processes for future conflicts on the cyber battlefield.

In contrast to simulated traditional war games, which fail to replicate the real experience of war, virtual war games will be nearly identical to actual cyber warfare. Thus, the military can safely examine both cyber offensive and defensive tactics in an isolated network environment, an ability that can enable the development of both "attack" and "defense" geniuses. Further, virtual fighting within the CPG would not make the same physical demands on participants. In the CPG system, it will not matter how far or fast someone can run; in fact, he or she may not have to be able to run at all in order to possess genius in the virtual realm created by this system.

Violence Is Inherent in the Traditional System of War

Clausewitz posited that violence is the "first-born son of war."[13] Because of this intrinsic violence, a military genius must possess both physical and moral courage. Cyberspace, however, does not embody or employ violence in the traditional sense. Destruction can occur, but it is neither permanent nor unrecoverable.[14] Destruction in cyberspace, therefore, does not equate to death and defeat. Unlike physical war, cyberspace is not only the medium but also the message.[15] Media theorist Marshall McLuhan suggested that advanced technological communication mediums, such as the Internet or telecommunication systems, have evolved into their own messages to share with the world. Furthermore, McLuhan theorized that evolutions in communication systems would lead to the creation of a global network or village.[16] An enemy cannot permanently destroy cyberspace or eliminate a cyber opponent because they have become too entrenched in McLuhan's global village, with layers of redundancies and ever-increasing dependencies on the cyberspace system. This lack of violence and death enables potential commanders to do something that Clausewitz deemed impossible: purposely discover, learn, and develop genius.

The initial opportunity to develop cyber genius could occur during development of the CPG system. A CPG truly attractive to a variety of participants would need to embrace cutting-edge, "massively multiplayer online role-playing game" (MMORPG) technology with real-world implications and applications. The US government needs to recruit software developers on par with Blizzard or Nintendo programmers in order to develop a viable CPG. It could do so by using the "Goldcorp Challenge."[17] That is, DOD leaders could propose the challenge of

developing a viable CPG on par with the MMORPG *World of Warcraft* or the virtual world *Second Life*, offering a lucrative cash reward along with an implementation contract for the winning format. During the development stage, an integrated product team could be established to allow both DOD and non-DOD personnel to exchange ideas and concepts. The process could result in increased understanding among all parties as well as an interesting and effective simulation.

The notion that one can learn genius resembles Alan Kay's theory that manipulation of "ideas through the medium of the computer would transform the way one thinks."[18] Through a CPG system's iterative process, participants would learn from the system and from one another—a method of teaching and learning posited by Palmer in which the "amateurs" learn about the "object" from each other, allowing them to become "knowers" instead of remaining amateurs.[19] Communities of participants or knowers could exchange ideas and information in efforts to overcome CPG challenges in this ideagora. The mass collaboration among participants and CPG developers would benefit the individuals involved, their respective organizations, and the system itself.

As technology advances, a CPG could evolve into an artificial intelligence system and thus become another form of cyber genius in its own right. As the system interacts with human participants, the CPG could adapt to human responses and craft even more challenging scenarios. Again, the chess world has already demonstrated this possibility with the development of IBM's Deep Blue computer, which defeated world chess champion Garry Kasparov in 1997, the first time a computer had beaten a top-ranked human competitor.[20] (The Elo system had ranked Kasparov number one in the chess world.) This concept, known in the gaming world as "botting," already exists as prosumer gamers develop code to allow automated systems to engage in game play and maximize the human participant's performance.[21] As Kay has theorized and as this new generation of computer programmers has exploited, a learning system "should immediately extrapolate and simulate an idea, offering the user a vision of new worlds and possibilities of his or her own thinking."[22] The CPG would give participants a chance to learn, individually or in groups, and would rank them, based on their abilities, while continually expanding its capabilities. The process could continue as long as the US government employs the system, offering US leaders various options for dealing with potential cyber threats. Context would shape content within the CPG, limited only by human imagination. The CPG could enable humans "to create things that could or couldn't, should or shouldn't, exist."[23]

Conclusion

Within the cyber realm, virtual reality replaces the physical realm, and the traditional knowledge structure has shifted. Violence, the most obvious aspect of traditional war, does not dominate cyberspace conflict. Younger generations possess the knowledge and experience in cyber applications that senior leaders and commanders often lack. CPGs allow commanders to wage actual cyber war with near-instantaneous feedback on successes and failures, speed, clarity, and coup d'oeil while tapping into the experiences and knowledge of their younger subordinates. Genius could reveal itself through this iterative process of in-depth study of past performances, tests, and evaluations. CPGs would allow for continuous assessment of potential cyber commanders and mitigate the physical demands of traditional warfare. Similar to the Elo system of chess ranking, the CPG could assign rankings to participants, based on their performance within the system. Without physical constraints, genius could arise from various backgrounds. Younger, physically or mentally handicapped, elderly, or overweight people; a collection of individuals; or artificial intelligence itself could all develop their own genius beside able-bodied military or nonmilitary leaders. Encouraged

and embraced by their senior leaders, younger generations can step forward to become subject-matter experts.

The cyber realm frees humanity from physical realities associated with traditional war. Within cyberspace, *death is not final*. The discovery of cyber genius does not depend upon actual war; CPGs using an Elo-styled ranking system could quickly discern between commanders with and those without cyber coup d'oeil. CPGs could also continuously evaluate personnel who overcome challenges more effectively while improving the performance of all participants. Just as Clausewitzian genius could arise only on battlefields, so can cyber genius emerge only within the cyber realm. Thus, the search for that genius should take place not on the battlefield but within the cyber domain itself. ✪

Maxwell AFB, Alabama

Notes

1. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 100.
2. Ibid., 89.
3. Clausewitz used the French term *coup d'oeil* ("glance") to refer to "the quick recognition of a truth that the mind would ordinarily miss or would perceive only after long study and reflection." Ibid., 102.
4. Paul T. Mitchell and the International Institute for Strategic Studies, *Network Centric Warfare: Coalition Operations in the Age of US Military Primacy* (London: International Institute for Strategic Studies, 2006), 35.
5. Parker J. Palmer, *The Courage to Teach: Exploring the Inner Landscape of a Teacher's Life* (San Francisco: Jossey-Bass, 1998), 102–3.
6. Don Tapscott and Anthony D. Williams, *Wikinomics: How Mass Collaboration Changes Everything* (New York: Portfolio, 2006), 112.
7. Mitchell and the International Institute for Strategic Studies, *Network Centric Warfare*, 35.
8. Tapscott and Williams, *Wikinomics*, 56.
9. Ibid., 98.
10. The Goldwater-Nichols Department of Defense Reorganization Act of 1986 brought numerous changes to the DOD in an attempt to mitigate interservice rivalries by clarifying the roles of the service chiefs and the chairman of the Joint Chiefs of Staff. Established because of failures of the services to communicate effectively during the botched attempt to rescue the Iranian hostages in 1979 and the invasion of Grenada in 1983, the act elucidated the lines of communication between the services and the Office of the Secretary of Defense. Some individuals contend that we need a Goldwater-Nichols II to help streamline communication between the DOD and other government agencies such as the State Department, Department of Energy, and the Central Intelligence Agency.
11. Adam Brate, *Technomanifestos: Visions from the Information Revolutionaries* (New York: Texere, 2002), 217.
12. Tapscott and Williams, *Wikinomics*, 132. Don Tapscott is chief executive of New Paradigm, a think tank and strategy consulting company.
13. Clausewitz, *On War*, 99.
14. See Martin C. Libicki and Rand Corporation, *Conquest in Cyberspace: National Security and Information Warfare* (New York: Cambridge University Press, 2007).
15. Brate, *Technomanifestos*, 195.
16. Ibid., 198.
17. Tapscott and Williams, *Wikinomics*, 9. The Goldcorp Challenge involved efforts by Goldcorp to extract gold from a dying gold mine in Ontario. In 1999 Rob McEwen, chief executive officer of that company, placed all of the geological information from the mine on the Internet and offered $575,000 in prize money to anyone who could figure out how to access the remaining gold. The contestants' identification of 110 substantial deposits of gold transformed Goldcorp from a $100 million company to one worth $9 billion.
18. Ibid., 173.
19. Palmer, *The Courage to Teach*, 102.
20. Dylan Loeb McClain, "Once Again, Machine Beats Human Champion at Chess," *New York Times*, 5 December 2006, http://www.nytimes.com/2006/12/05/crosswords/chess/05cnd-chess.html?_r=1 (accessed 1 December 2009).
21. Most MMORPGs, like *World of Warcraft*, have rules against botting since it gives certain players an unfair advantage over others, particularly in player-versus-player realms.
22. Brate, *Technomanifestos*, 173.
23. Ibid., 177.